CLAIMS

1. Process for synthesizing nanorods of a carbide of one metal M1 on a substrate, which comprises the following steps:

a) the deposition, on the substrate, of a layer comprising nanocrystals of oxide of the metal M1 and nanocrystals of oxide of at least one metal M2 different from the metal M1, the M1 metal oxide nanocrystals being dispersed within this layer;

b) the reduction of the M1 and M2 metal oxide nanocrystals into corresponding metal nanocrystals; and

c) the selective growth of the M1 metal nanocrystals.

2. Synthesis process according to claim 1, in which step a) is carried out by reactive sputtering from a target consisting of the metals M1 and M2 by an oxygen plasma produced by an electron cyclotron resonance microwave plasma source.

3. Synthesis process according to claim 2, in which said target is made of a mixture of the metals M1 and M2.

4. Synthesis process according to claim 2, in which said target comprises several zones, adjacent to one another or separated from one another, at least one of these zones consisting of the metal M1, whereas the one or more other of these zones consist(s) of the metal or metals M2.

5. Synthesis process according to any one of the preceding claims, in which step b) is carried out by a hydrogen plasma produced by an electron cyclotron resonance microwave plasma source, the substrate being heated.

6. Synthesis process according to any one of the preceding claims, in which step c) is carried out by a plasma of at least one hydrocarbon produced by an electron cyclotron resonance microwave plasma source, the substrate being heated.

7. Synthesis process according to any one of the preceding claims, in which the metal M1 is chosen from the group consisting of metals capable of reacting with organic molecules or radicals that are in gaseous form in order to form, with them, a metal carbide.

8. Synthesis process according to claim 7, in which the metal M1 is chosen from the group consisting of chromium and molybdenum, and is preferably chromium.

9. Synthesis process according to any one of the preceding claims, in which the metal or metals M2 are chosen from the group consisting of metals known as catalysts in organic chemistry.

10. Synthesis process according to claim 9, in which the metal or metals M2 are chosen from the group

consisting of iron, nickel and cobalt, and preferably from the group consisting of iron and nickel.

11. Synthesis process according to any one of claims 2 to 10, in which said target is made of a stainless steel composed of iron and chromium, or of iron, chromium and nickel.

12. Synthesis process according to claim 10, in which said target is biased with a negative voltage of -200 V or higher and preferably of between -400 and -200 V.

13. Synthesis process according to claim 10 or claim 11, in which said oxygen plasma is maintained at a pressure of generally 10^{-3} mbar or below, and preferably between 10^{-4} and 10^{-3} mbar.

14. Synthesis process according to any one of claims 5 to 13, in which, in step b), the hydrogen plasma is maintained at a pressure of 10^{-2} mbar or below, and advantageously between 10^{-3} and 10^{-2} mbar, and the substrate is heated to a temperature ranging from 300 to 600°C.

15. Synthesis process according to any one of claims 6 to 14, in which, in step c), the hydrocarbon plasma is maintained at a pressure of 10^{-2} mbar or below, and preferably between 10^{-3} and 10^{-2} mbar, while the substrate is heated to a temperature of 600°C or higher, and preferably between 600 and 800°C.

16. Synthesis process according to any one of claims 6 to 15, in which the hydrocarbon or hydrocarbons used in step c) are chosen from the group consisting of alkanes, alkenes and alkynes, and is preferably ethylene.

17. Synthesis process according to any one of the preceding claims, in which the substrate is chosen from the group consisting of silicon, borosilicate glasses, quartz, metals and metal alloys.

18. Process for growing nanorods of a carbide of one metal M1 on a substrate, which consists in subjecting nanocrystals of the metal M1 dispersed within a layer of nanocrystals of at least one metal M2 different from M1, said layer being deposited beforehand on the substrate, to the action of a plasma of at least one hydrocarbon produced by an ECR microwave plasma source.

19. Growth process according to claim 18, in which the metal M1 is chosen from the group consisting of metals capable of reacting with organic molecules or radicals that are in gaseous form in order to form, with them, a metal carbide.

20. Growth process according to claim 19, in which the metal M1 is chosen from the group consisting of chromium and molybdenum, and is preferably chromium.

21. Growth process according to any one of claims 18 to 20, in which the metal or metals M2 are chosen from

the group consisting of metals known as catalysts in organic chemistry.

22. Growth process according to claim 21, in which the metal or metals M2 are chosen from the group consisting of iron, nickel and cobalt, and preferably from the group consisting of iron and nickel.

23. Growth process according to any one of claims 18 to 22, in which the hydrocarbon plasma is maintained at a pressure of 10^{-2} mbar or below and preferably of between 10^{-3} and 10^{-2} mbar, while the substrate is heated to a temperature of 600°C or higher, and preferably of between 600 and 800°.

24. Growth process according to any one of claims 18 to 23, in which the hydrocarbon or hydrocarbons are chosen from the group consisting of alkanes, alkenes and alkynes, and is preferably ethylene.

25. Growth process according to any one of claims 18 to 24, in which the substrate is chosen from the group consisting of silicon, borosilicate glasses, quartz, metals and metal alloys.

26. Substrate having metal carbide nanorods attached to its surface, perpendicular to the principal plane of this substrate, and physically separate from one another.

27. Substrate according to claim 26, in which the metal carbide nanorods measure 5 to 100 nm in diameter and 100 nm to 1 µm in length.

28. Substrate according to claim 26 or claim 27, in which the metal carbide nanorods are chromium carbide nanorods.

29. Application of a substrate according to any one of claims 26 to 28 to the fabrication of microsystems provided with chemical or biological functionalities, and in particular to the fabrication of biosensors.

30. Application of a substrate according to any one of claims 26 to 28 to the fabrication of electron emission sources, especially for flat television or computer screens.